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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Industrial Application]This invention relates to the novolac type phenol resin composition for friction materials excellent in the friction characteristic.

[0002]

[Description of the Prior Art]Friction materials, such as brake lining, disk pads, and clutch facing, are used for the car and the industrial machine for braking of power, or transfer. Generally this friction material combines inorganic additives, such as organic additives, such as substrates, such as asbestos, glass fiber, an aramid fiber, and a metal fiber, cashew dust, melamine dust, and rubber dust, and barium sulfate, calcium carbonate, wollastonite, and copper powder, etc. by resin of a phenol system, and is made. Evaluation of this friction material is performed based on mechanical properties, such as friction performances, such as a coefficient of friction, abrasion loss, a squeal, etc. at the time of an elevated temperature (allophone generated at the time of braking), and flexural strength, shear strength, etc. On the other hand, the improvement in the braking stability under a severe condition and the feeling nature by reduction of a squeal and reduction of the offensive odor by cracked gas are strongly demanded [as opposed to / especially / this friction material] with improvement in the speed of a rapid means of transportation of these days. It is supposed that the factor which influences the valuation characteristics of a friction material most greatly under such a situation is based on selection of a binding material. Generally as this binding material, phenol resin is used from fields, such as heat resistance, abrasion resistance, and a mechanical strength.

[0003]In order to improve said many performances as phenol resin, research of modified phenol resin is done briskly, The oil modified phenol resin, the cashew modified phenol resin, the rubber modified phenol resin, epoxy modified phenol resin, melamine modified phenol resin, etc. which are excellent in pliability are examined. However, in particular since heat resistance was inferior, the braking stability under a severe condition was not obtained, but the squeal occurred, and these modified phenol resin was insufficient. The offensive odor occurred and there was also an environmental problem. In the case of these modified phenol resin, compared with native phenol resin, hardenability became late, and there was a difficulty that a moldability and workability are bad.

[0004]

[Problem(s) to be Solved by the Invention]In order that this invention might solve such a problem of the conventional friction material, it was made as a result of various examination, and there is a place made into the purpose in providing the novolac type phenol resin composition for friction materials excellent in the friction characteristic, workability, and environmental protection nature.

[0005]

[Means for Solving the Problem]In order to solve said problem, as a result of inquiring wholeheartedly, this invention finds out that one nuclide and a dicaryon ingredient influence greatly, and came to complete this invention. Namely, this invention is novolac type phenol resin from which a phenol resin ingredient is obtained considering phenols, formaldehyde, and acid as an essential ingredient in a constituent for friction materials, It is related with a novolac type phenol resin composition for friction materials, wherein content of 1 nuclide ingredient in phenol resin is 1 or less % of the weight and content of a dicaryon ingredient is 2 or less % of the weight.

[0006]Hereafter, this invention is explained concretely. An isolation monomer is most although 1 nuclide ingredients in phenol resin are an unreacted isolation monomer and 2-methylol phenols, 4-methylol phenols, etc. Dicaryon ingredients in phenol resin are 2,2'-dihydroxydiphenylmethanes, 2,4'-dihydroxydiphenylmethanes, and 4,4'-dihydroxydiphenylmethanes. in order for the amount of [many] low molecule to remain into a friction material hardened when 1 or less % of the weight was desirable as for content of 1 nuclide ingredient in the above-mentioned phenol resin and it exceeded 1 % of the weight -- the shaping back -- an isolation monomer volatilizes especially to post cure **, mold goods are cracked, a moldability worsens, and it has an adverse effect on the friction characteristic. Content of a dicaryon ingredient in phenol resin, Two or less % of the weight is desirable, when it exceeded 2 % of the weight and is exposed to the bottom of an elevated temperature especially at the time of braking, while a dicaryon ingredient carries out a volatile-matter-content solution and reducing a coefficient of friction on the surface of a friction material, a squeal occurs by change of a coefficient of friction, and an ingredient which carried out the volatile-matter-content solution further releases an offensive odor, and worsens environment.

[0007]In this invention, number average molecular weights of novolac type phenol resin are 300-800 preferably. The melting point of phenol resin falls [a number average molecular weight] by less than 300, and it becomes easy to produce union. If it exceeds 800, the mobility of resin falls, it will become uneven and a mechanical strength will fall. Ratios of weight average molecular weight to a number average molecular weight of this novolac type phenol resin are 1.0-2.0 preferably. This ratio. By less than 1.0, porosity of a friction material with which the mobility of resin was obtained by being too high becomes small, and a coefficient of friction falls. Variation arises in the degree of hardening of resin in a friction material obtained when it exceeded 2.0, and a stable coefficient of friction is no longer obtained.

[0008]As phenols here Phenol, cresol, a xylenol, They are used, resorcinol, catechol, hydroquinone, bisphenol A, the bisphenol F, propenylphenol, butylphenol, octylphenol, nonyl phenol, etc. being independent, or using together. They are used as aldehyde, formaldehyde, paraformaldehyde, a trioxane, acetaldehyde, benzaldehyde, etc. being

independent, or using together. metal salt, such as organic acid and inorganic acid which are used as acid used as a catalyst when [, such as oxalic acid, chloride, nitric acid, Para toluenesulfonic acid, zinc acetate, zinc carbonate, and acetic acid,] manufacturing novolac type phenol resin generally, or it, is independent -- or it is used together and used. Novolac type phenol resin of this invention is obtained by [which carry out back dehydration] having heated these phenols, formaldehyde, and a catalyst after teaching a reaction vessel, and having carried out addition condensation. Especially in dehydration, under decompression, temperature up of the temperature of a resultant is carried out to 220-300 **, and it is obtained.

[0009]

[Example] Hereafter, an example explains this invention. However, this invention is not limited by these examples. A "weight section" and "% of the weight" are shown a "part" and all "%" indicated to the example and the comparative example.

<<Example 1>> Subsequently 1500 copies of phenol and 711 copies of 37% formalin taught 15 copies of oxalic acid to the condensator and the reaction vessel with an agitator. After carrying out temperature up gradually and reaching the temperature of 95 **, the flowing-back reaction was performed for 180 minutes. Subsequently, dehydration was performed under decompression of 60Torr, drying was continued, blowing nitrogen gas from the time of temperature reaching 150 **, and heating was continued, and the internal temperature was 230 ** and it continued at this temperature for further 4 hours. Subsequently, after performing vacuum drying under decompression of 20Torr for 1 hour, it discharged from the reaction vessel and 1150 copies of solid novolac type phenol resin was obtained at ordinary temperature.

<<Example 2>> Subsequently 1200 copies of phenol, 300 copies of cresol, and 693 copies of 37% formalin taught five copies of hydrochloric acid water to the condensator and the reaction vessel with an agitator 25%. After carrying out temperature up gradually and reaching the temperature of 95 **, the flowing-back reaction was performed for 180 minutes. Subsequently, dehydration was performed under decompression of 60Torr, drying was continued, blowing nitrogen gas from the time of temperature reaching 150 **, and heating was continued, and the internal temperature was 230 ** and it continued at this temperature for further 4 hours. Subsequently, after performing vacuum drying under decompression of 20Torr for 1 hour, it discharged from the reaction vessel and 1180 copies of solid cresol denaturation novolac type phenol resin was obtained at ordinary temperature.

[0010]<<Example 3>> Subsequently 1500 copies of bisphenol A and 511 copies of 37% formalin taught 15 copies of oxalic acid to the condensator and the reaction vessel with an agitator. After carrying out temperature up gradually and reaching the temperature of 95 **, the flowing-back reaction was performed for 180 minutes. Subsequently, dehydration was performed under decompression of 60Torr, drying was continued, blowing nitrogen gas from the time of temperature reaching 150 **, and heating was continued, and the internal temperature was 230 ** and it continued at this temperature for further 4 hours. Subsequently, after performing vacuum drying under decompression of 20Torr for 1 hour, it discharged from the reaction vessel and 1350 copies of solid novolac type phenol resin was obtained at ordinary temperature.

<<Example 4>> Subsequently 1500 copies of phenol and 906 copies of 37% formalin taught 15 copies of oxalic acid to the condensator and the reaction vessel with an agitator. After carrying out temperature up gradually and reaching the temperature of 95 **, the flowing-back reaction was performed for 180 minutes. Subsequently, dehydration was performed under decompression of 60Torr, drying was continued, blowing nitrogen gas from the time of temperature reaching 150 **, and heating was continued, and the internal temperature was 260 ** and it continued at this temperature for further 4 hours. Subsequently, after performing vacuum drying under decompression of 20Torr for 3 hours, it discharged from the reaction vessel and 1550 copies of solid novolac type phenol resin was obtained at ordinary temperature.

[0011]<<Comparative example 1>> Subsequently 1500 copies of phenol and 806 copies of 37% formalin taught 15 copies of oxalic acid to the condensator and the reaction vessel with an agitator. After carrying out temperature up gradually and reaching the temperature of 95 **, the flowing-back reaction was performed for 180 minutes. Subsequently, under decompression of 60Torr, dehydration was performed and it heated to the temperature of 230 **. Subsequently, after performing vacuum drying under decompression of 20Torr for 3 hours, it discharged from the reaction vessel and 1350 copies of solid novolac type phenol resin was obtained at ordinary temperature.

<<Comparative example 2>> Subsequently 1500 copies of phenol and 840 copies of 37% formalin taught 15 copies of oxalic acid to the condensator and the reaction vessel with an agitator. After carrying out temperature up gradually and reaching the temperature of 95 **, the flowing-back reaction was performed for 180 minutes. Subsequently, after it performed dehydration under decompression of 60Torr and temperature reached 150 **, it discharged from the reaction vessel and 1450 copies of solid novolac type phenol resin was obtained at ordinary temperature.

[0012]<<Comparative example 3>> Subsequently 1500 copies of phenol and 776 copies of 37% formalin taught 15 copies of oxalic acid to the condensator and the reaction vessel with an agitator. After carrying out temperature up gradually and reaching the temperature of 95 **, the flowing-back reaction was performed for 180 minutes. Subsequently, dehydration was performed under decompression of 60Torr and temperature heated to 200 **. After performing vacuum drying for 1 hour by the temperature of 200-210 **, and degree-of-vacuum 20Torr, 1420 copies of solid novolac type phenol resin was obtained by discharge ***** from the reaction vessel.

<<Comparative example 4>> Subsequently 1500 copies of phenol and 1035 copies of 37% formalin taught 15 copies of oxalic acid to the condensator and the reaction vessel with an agitator. After carrying out temperature up gradually and reaching the temperature of 95 **, the flowing-back reaction was performed for 180 minutes. Subsequently, dehydration was performed under decompression of 60Torr and temperature heated to 200 **. After performing vacuum drying for 1 hour by the temperature of 200-210 **, and degree-of-vacuum 20Torr, 1500 copies of solid novolac type phenol resin was obtained by discharge ***** from the reaction vessel.

[0013]About eight kinds of novolac type phenol resin obtained by Examples 1, 2, 3, and 4 and the comparative examples 1, 2, 3, and 4. 1 nuclide quantitative formula by high speed liquid chromatography, a dicaryon quantitative formula, a number average molecular

weight, weight average molecular weight, a dispersion index, and the odor unit by the Tokyo three-point attitude comparison odor bag method are measured, and the result is shown in Table 1.

[Table 1]

表 1 ノボラック型フェノール樹脂の特性

実 験 例 特 性	実 施 例				比 較 例			
	1	2	3	4	1	2	3	4
1 核体成分含有量 (%)	0.1	0.1	0.2	0.1	0.1	6.2	0.8	0.2
2 核体成分含有量 (%)	1.0	0.9	1.3	1.1	1.2	12.1	13.0	9.0
数平均分子量 Mn	440	530	475	600	550	510	495	750
重量平均分子量 Mw	560	920	691	970	1200	1090	900	1430
分散度指数 Mw/Mn	1.3	1.5	1.5	1.6	2.2	2.1	1.8	1.9
臭 気 濃 度	130	120	240	150	160	2400	1300	1100

[0014](Measuring method of an odor unit) Each phenol resin 0.1 g is respectively put on a ceramic board independently, Subsequently, it inserted in the combustion tube of the ceramics held at 300 ** independently respectively, and sent for 10 minutes by the flow for 1L/by having made clean air into carrier gas simultaneously, and the collection of the cracked gas was carried out to the pure sample bag of 10L with carrier gas. After diluting this gas to the Tokyo three-point attitude comparison odor bag method ****, 30 times, 100 times, 300 times, 1000 times, and 3000 times, six persons' operating personnel smelled this dilution gas, and from the highest dilution magnification which senses a bad smell, the odor unit was calculated statistically and it asked for it.

[0015]Next, said eight kinds of novolac type phenol resin was respectively ground with the hardening agent independently, and it powdered, and taught and mixed by the blending ratio shown in Table 2.

[Table 2]

表 2 配 合 割 合

配 合 物	配合量(重量%)
アラミド繊維	5
硫酸バリウム	65
樹 脂	10
その他の配合物	20

After fabricating this compound by the temperature of 160 **, and the pressure of 200 kg / cm² for 10 minutes, it calcinated at 200 ** for 5 hours, and the friction material was created.

A rubbing test is done according to these JIS D 4411, and the result is shown in Table 3 and 4.

[0016]

[Table 3]

表 3 摩擦試験結果

温度 (℃)	実施例1		実施例2		実施例3		実施例4	
	摩擦係数	摩耗量	摩擦係数	摩耗量	摩擦係数	摩耗量	摩擦係数	摩耗量
100	0.37	1.0	0.38	0.7	0.37	0.7	0.38	0.6
150	0.38	1.4	0.40	0.7	0.39	0.4	0.39	0.9
200	0.38	2.3	0.39	1.2	0.38	1.3	0.40	1.1
250	0.36	3.3	0.37	2.3	0.36	2.0	0.37	2.2
300	0.33	4.8	0.36	3.8	0.35	3.8	0.35	4.0
350	0.33	6.2	0.36	5.7	0.35	4.9	0.36	5.7
100	0.36	1.8	0.38	1.5	0.36	2.4	0.38	1.9

[0017]

[Table 4]

表 4 摩擦試験結果

温度 (℃)	比較例1		比較例2		比較例3		比較例4	
	摩擦係数	摩耗量	摩擦係数	摩耗量	摩擦係数	摩耗量	摩擦係数	摩耗量
100	0.37	1.7	0.33	1.3	0.35	1.0	0.35	1.3
150	0.38	2.7	0.30	2.1	0.33	1.9	0.34	2.9
200	0.36	3.2	0.30	3.3	0.31	3.1	0.34	3.1
250	0.34	4.3	0.29	4.7	0.30	4.2	0.33	4.7
300	0.30	8.8	0.26	7.8	0.28	7.0	0.33	8.0
350	0.30	13.7	0.24	13.1	0.26	10.7	0.30	11.7
100	0.34	4.5	0.28	2.4	0.30	1.9	0.33	1.9

[0018]

[Effect of the Invention]By using the novolac type phenol resin composition by this invention, a coefficient of friction is stabilized at the time of braking by a severe condition, and it excels in abrasion resistance and a mechanical strength, and a squeal and a bad smell are reduced, and it is suitable for braking part articles, such as a car, a rail car, an airplane, and an industrial machine.

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TECHNICAL FIELD

[Industrial Application]This invention relates to the novolac type phenol resin composition for friction materials excellent in the friction characteristic.

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PRIOR ART

[Description of the Prior Art]Friction materials, such as brake lining, disk pads, and clutch facing, are used for the car and the industrial machine for braking of power, or transfer. Generally this friction material combines inorganic additives, such as organic additives, such as substrates, such as asbestos, glass fiber, an aramid fiber, and a metal fiber, cashew dust, melamine dust, and rubber dust, and barium sulfate, calcium carbonate, wollastonite, and copper powder, etc. by resin of a phenol system, and is made. Evaluation of this friction material is performed based on mechanical properties, such as friction performances, such as a coefficient of friction, abrasion loss, a squeal, etc. at the time of an elevated temperature (allophone generated at the time of braking), and flexural strength, shear strength, etc. On the other hand, the improvement in the braking stability under a severe condition and the feeling nature by reduction of a squeal and reduction of the offensive odor by cracked gas are strongly demanded [as opposed to / especially / this friction material] with improvement in the speed of a rapid means of transportation of these days. It is supposed that the factor which influences the valuation characteristics of a friction material most greatly under such a situation is based on selection of a binding material. Generally as this binding material, phenol resin is used from fields, such as heat resistance, abrasion resistance, and a mechanical strength.

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EFFECT OF THE INVENTION

[Effect of the Invention]By using the novolac type phenol resin composition by this invention, a coefficient of friction is stabilized at the time of braking by a severe condition, and it excels in abrasion resistance and a mechanical strength, and a squeal and a bad smell are reduced, and it is suitable for braking part articles, such as a car, a rail car, an airplane, and an industrial machine.

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention]In order that this invention might solve such a problem of the conventional friction material, it was made as a result of various examination, and there is a place made into the purpose in providing the novolac type phenol resin composition for friction materials excellent in the friction characteristic, workability, and environmental protection nature.

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EXAMPLE

[Example]Hereafter, an example explains this invention. However, this invention is not limited by these examples. A "weight section" and "% of the weight" are shown a "part" and all"%" indicated to the example and the comparative example.

<<Example 1>> Subsequently 1500 copies of phenol and 711 copies of 37% formalin taught 15 copies of oxalic acid to the condensator and the reaction vessel with an agitator. After carrying out temperature up gradually and reaching the temperature of 95 **, the flowing-back reaction was performed for 180 minutes. Subsequently, dehydration was performed under decompression of 60Torr, drying was continued, blowing nitrogen gas from the time of temperature reaching 150 **, and heating was continued, and the internal temperature was 230 ** and it continued at this temperature for further 4 hours. Subsequently, after performing vacuum drying under decompression of 20Torr for 1 hour, it discharged from the reaction vessel and 1150 copies of solid novolac type phenol resin was obtained at ordinary temperature.

<<Example 2>> Subsequently 1200 copies of phenol, 300 copies of cresol, and 693 copies of 37% formalin taught five copies of hydrochloric acid water to the condensator and the reaction vessel with an agitator 25%. After carrying out temperature up gradually and reaching the temperature of 95 **, the flowing-back reaction was performed for 180 minutes. Subsequently, dehydration was performed under decompression of 60Torr, drying was continued, blowing nitrogen gas from the time of temperature reaching 150 **, and heating was continued, and the internal temperature was 230 ** and it continued at this temperature for further 4 hours. Subsequently, after performing vacuum drying under decompression of 20Torr for 1 hour, it discharged from the reaction vessel and 1180 copies of solid cresol denaturation novolac type phenol resin was obtained at ordinary temperature.

[0010]<<Example 3>> Subsequently 1500 copies of bisphenol A and 511 copies of 37% formalin taught 15 copies of oxalic acid to the condensator and the reaction vessel with an agitator. After carrying out temperature up gradually and reaching the temperature of 95 **, the flowing-back reaction was performed for 180 minutes. Subsequently, dehydration was performed under decompression of 60Torr, drying was continued, blowing nitrogen gas from the time of temperature reaching 150 **, and heating was continued, and the internal temperature was 230 ** and it continued at this temperature for further 4 hours. Subsequently, after performing vacuum drying under decompression of 20Torr for 1 hour, it

discharged from the reaction vessel and 1350 copies of solid novolac type phenol resin was obtained at ordinary temperature.

<<Example 4>> Subsequently 1500 copies of phenol and 906 copies of 37% formalin taught 15 copies of oxalic acid to the condensator and the reaction vessel with an agitator. After carrying out temperature up gradually and reaching the temperature of 95 **, the flowing-back reaction was performed for 180 minutes. Subsequently, dehydration was performed under decompression of 60Torr, drying was continued, blowing nitrogen gas from the time of temperature reaching 150 **, and heating was continued, and the internal temperature was 260 ** and it continued at this temperature for further 4 hours.

Subsequently, after performing vacuum drying under decompression of 20Torr for 3 hours, it discharged from the reaction vessel and 1550 copies of solid novolac type phenol resin was obtained at ordinary temperature.

[0011]<<Comparative example 1>> Subsequently 1500 copies of phenol and 806 copies of 37% formalin taught 15 copies of oxalic acid to the condensator and the reaction vessel with an agitator. After carrying out temperature up gradually and reaching the temperature of 95 **, the flowing-back reaction was performed for 180 minutes. Subsequently, under decompression of 60Torr, dehydration was performed and it heated to the temperature of 230 **. Subsequently, after performing vacuum drying under decompression of 20Torr for 3 hours, it discharged from the reaction vessel and 1350 copies of solid novolac type phenol resin was obtained at ordinary temperature.

<<Comparative example 2>> Subsequently 1500 copies of phenol and 840 copies of 37% formalin taught 15 copies of oxalic acid to the condensator and the reaction vessel with an agitator. After carrying out temperature up gradually and reaching the temperature of 95 **, the flowing-back reaction was performed for 180 minutes. Subsequently, after it performed dehydration under decompression of 60Torr and temperature reached 150 **, it discharged from the reaction vessel and 1450 copies of solid novolac type phenol resin was obtained at ordinary temperature.

[0012]<<Comparative example 3>> Subsequently 1500 copies of phenol and 776 copies of 37% formalin taught 15 copies of oxalic acid to the condensator and the reaction vessel with an agitator. After carrying out temperature up gradually and reaching the temperature of 95 **, the flowing-back reaction was performed for 180 minutes. Subsequently, dehydration was performed under decompression of 60Torr and temperature heated to 200 **. After performing vacuum drying for 1 hour by the temperature of 200-210 **, and degree-of-vacuum 20Torr, 1420 copies of solid novolac type phenol resin was obtained by discharge ***** from the reaction vessel.

<<Comparative example 4>> Subsequently 1500 copies of phenol and 1035 copies of 37% formalin taught 15 copies of oxalic acid to the condensator and the reaction vessel with an agitator. After carrying out temperature up gradually and reaching the temperature of 95 **, the flowing-back reaction was performed for 180 minutes. Subsequently, dehydration was performed under decompression of 60Torr and temperature heated to 200 **. After performing vacuum drying for 1 hour by the temperature of 200-210 **, and degree-of-vacuum 20Torr, 1500 copies of solid novolac type phenol resin was obtained by discharge ***** from the reaction vessel.

[0013]About eight kinds of novolac type phenol resin obtained by Examples 1, 2, 3, and 4

and the comparative examples 1, 2, 3, and 4. 1 nuclide quantitative formula by high speed liquid chromatography, a dicaryon quantitative formula, a number average molecular weight, weight average molecular weight, a dispersion index, and the odor unit by the Tokyo three-point attitude comparison odor bag method are measured, and the result is shown in Table 1.

[Table 1]

表 1 ノボラック型フェノール樹脂の特性

実 験 例 特 性	実 施 例				比 較 例			
	1	2	3	4	1	2	3	4
1 核体成分含有量 (%)	0.1	0.1	0.2	0.1	0.1	6.2	0.8	0.2
2 核体成分含有量 (%)	1.0	0.9	1.3	1.1	1.2	12.1	13.0	9.0
数平均分子量 Mn	440	530	475	600	550	510	495	750
重量平均分子量 Mw	560	920	691	970	1200	1090	900	1430
分散度指数 Mw/Mn	1.3	1.5	1.5	1.6	2.2	2.1	1.8	1.9
臭 気 濃 度	130	120	240	150	160	2400	1300	1100

[0014](Measuring method of an odor unit) Each phenol resin 0.1 g is respectively put on a ceramic board independently, Subsequently, it inserted in the combustion tube of the ceramics held at 300 ** independently respectively, and sent for 10 minutes by the flow for 1L/by having made clean air into carrier gas simultaneously, and the collection of the cracked gas was carried out to the pure sample bag of 10L with carrier gas. After diluting this gas to the Tokyo three-point attitude comparison odor bag method ****, 30 times, 100 times, 300 times, 1000 times, and 3000 times, six persons' operating personnel smelled this dilution gas, and from the highest dilution magnification which senses a bad smell, the odor unit was calculated statistically and it asked for it.

[0015]Next, said eight kinds of novolac type phenol resin was respectively ground with the hardening agent independently, and it powdered, and taught and mixed by the blending ratio shown in Table 2.

[Table 2]

表 2 配 合 割 合

配 合 物	配合量(重量%)
アラミド繊維	5
硫酸バリウム	65
樹 脂	10
その他の配合物	20

After fabricating this compound by the temperature of 160 **, and the pressure of 200 kg /

cm² for 10 minutes, it calcinated at 200 °C for 5 hours, and the friction material was created. A rubbing test is done according to these JIS D 4411, and the result is shown in Table 3 and 4.

[0016]

[Table 3]

表 3 摩擦試験結果

温度 (°C)	実施例 1		実施例 2		実施例 3		実施例 4	
	摩擦係数	摩耗量	摩擦係数	摩耗量	摩擦係数	摩耗量	摩擦係数	摩耗量
100	0.37	1.0	0.38	0.7	0.37	0.7	0.38	0.6
150	0.38	1.4	0.40	0.7	0.39	0.4	0.39	0.9
200	0.38	2.3	0.39	1.2	0.38	1.3	0.40	1.1
250	0.36	3.3	0.37	2.3	0.36	2.0	0.37	2.2
300	0.33	4.8	0.36	3.8	0.35	3.8	0.35	4.0
350	0.33	6.2	0.36	5.7	0.35	4.9	0.36	5.7
100	0.36	1.8	0.38	1.5	0.36	2.4	0.38	1.9

[0017]

[Table 4]

表 4 摩擦試験結果

温度 (°C)	比較例 1		比較例 2		比較例 3		比較例 4	
	摩擦係数	摩耗量	摩擦係数	摩耗量	摩擦係数	摩耗量	摩擦係数	摩耗量
100	0.37	1.7	0.33	1.3	0.35	1.0	0.35	1.3
150	0.38	2.7	0.30	2.1	0.33	1.9	0.34	2.9
200	0.36	3.2	0.30	3.3	0.31	3.1	0.34	3.1
250	0.34	4.3	0.29	4.7	0.30	4.2	0.33	4.7
300	0.30	8.8	0.26	7.8	0.28	7.0	0.33	8.0
350	0.30	13.7	0.24	13.1	0.26	10.7	0.30	11.7
100	0.34	4.5	0.28	2.4	0.30	1.9	0.33	1.9

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MEANS

[Means for Solving the Problem]In order to solve said problem, as a result of inquiring wholeheartedly, this invention finds out that one nuclide and a dicaryon ingredient influence greatly, and came to complete this invention. Namely, this invention is novolac type phenol resin from which a phenol resin ingredient is obtained considering phenols, formaldehyde, and acid as an essential ingredient in a constituent for friction materials, It is related with a novolac type phenol resin composition for friction materials, wherein content of 1 nuclide ingredient in phenol resin is 1 or less % of the weight and content of a dicaryon ingredient is 2 or less % of the weight.

[0006]Hereafter, this invention is explained concretely. An isolation monomer is most although 1 nuclide ingredients in phenol resin are an unreacted isolation monomer and 2-methylol phenols, 4-methylol phenols, etc. Dicaryon ingredients in phenol resin are 2,2'-dihydroxydiphenylmethanes, 2,4'-dihydroxydiphenylmethanes, and 4,4'-dihydroxydiphenylmethanes. in order for the amount of [many] low molecule to remain into a friction material hardened when 1 or less % of the weight was desirable as for content of 1 nuclide ingredient in the above-mentioned phenol resin and it exceeded 1 % of the weight -- the shaping back -- an isolation monomer volatilizes especially to post cure **, mold goods are cracked, a moldability worsens, and it has an adverse effect on the friction characteristic. Content of a dicaryon ingredient in phenol resin, Two or less % of the weight is desirable, when it exceeded 2 % of the weight and is exposed to the bottom of an elevated temperature especially at the time of braking, while a dicaryon ingredient carries out a volatile-matter-content solution and reducing a coefficient of friction on the surface of a friction material, a squeal occurs by change of a coefficient of friction, and an ingredient which carried out the volatile-matter-content solution further releases an offensive odor, and worsens environment.

[0007]In this invention, number average molecular weights of novolac type phenol resin are 300-800 preferably. The melting point of phenol resin falls [a number average molecular weight] by less than 300, and it becomes easy to produce union. If it exceeds 800, the mobility of resin falls, it will become uneven and a mechanical strength will fall. Ratios of weight average molecular weight to a number average molecular weight of this novolac type phenol resin are 1.0-2.0 preferably. This ratio. By less than 1.0, porosity of a friction material with which the mobility of resin was obtained by being too high becomes small, and a coefficient of friction falls. Variation arises in the degree of hardening of resin in a

friction material obtained when it exceeded 2.0, and a stable coefficient of friction is no longer obtained.

[0008]As phenols here Phenol, cresol, a xylenol, They are used, resorcinol, catechol, hydroquinone, bisphenol A, the bisphenol F, propenylphenol, butylphenol, octylphenol, nonyl phenol, etc. being independent, or using together. They are used as aldehyde, formaldehyde, paraformaldehyde, a trioxane, acetaldehyde, benzaldehyde, etc. being independent, or using together. metal salt, such as organic acid and inorganic acid which are used as acid used as a catalyst when [, such as oxalic acid, chloride, nitric acid, Para toluenesulfonic acid, zinc acetate, zinc carbonate, and acetic acid,] manufacturing novolac type phenol resin generally, or it, is independent -- or it is used together and used. Novolac type phenol resin of this invention is obtained by [which carry out back dehydration] having heated these phenols, formaldehyde, and a catalyst after teaching a reaction vessel, and having carried out addition condensation. Especially in dehydration, under decompression, temperature up of the temperature of a resultant is carried out to 220-300 **, and it is obtained.

[Translation done.]

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- 1.This document has been translated by computer. So the translation may not reflect the original precisely.
- 2.**** shows the word which can not be translated.
- 3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]

[Claim 1]It is novolac type phenol resin from which a phenol resin ingredient is obtained considering phenols, formaldehyde, and acid as an essential ingredient in a constituent for friction materials, A novolac type phenol resin composition for friction materials, wherein content of 1 nuclide ingredient in phenol resin is 1 or less % of the weight and content of a dicaryon ingredient is 2 or less % of the weight.

[Claim 2]The novolac type phenol resin composition for friction materials according to claim 1, wherein number average molecular weights of novolac type phenol resin are 300-800 and ratios of weight average molecular weight to a number average molecular weight are 1.0-2.0. [Claim 3]Novolac type phenol resin for friction materials, wherein content of 1 nuclide ingredient is 1 or less % of the weight, content of a dicaryon ingredient is 2 or less % of the weight, number average molecular weights are 300-800 and ratios of weight average molecular weight to a number average molecular weight are 1.0-2.0.

[Translation done.]